CLAIMS

1. A compound of formula I

in free or salt or solvate form, wherein

X is $-R^1$ -Ar- R^2 or $-R^2$ -Y;

Ar denotes a phenylene group optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₁-C₁₀-alkoxy-C₁-C₁₀-alkyl, phenyl, C₁-C₁₀-alkyl substituted by phenyl, C₁-C₁₀-alkoxy substituted by phenyl, C₁-C₁₀-alkyl-substituted phenyl or by C₁-C₁₀-alkoxy-substituted phenyl;

R¹ and R² are attached to adjacent carbon atoms in Ar, and either R¹ is C₁-C₁₀-alkylene and R² is hydrogen, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halogen or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6- or 7-membered cycloaliphatic ring;

R^a is a bond or C₁-C₁₀-alkylene optionally substituted by hydroxy, C₁-C₁₀-alkoxy, C₆-C₁₀-aryl or C₇-C₁₄-aralkyl; and

Y is C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₂-C₁₀-alkenyl or C₂-C₁₀-alkynyl optionally substituted by halo, cyano, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halo-C₁-C₁₀-alkyl;

C₃-C₁₀-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₃-C₁₀-cycloalkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyloxy or C₆-C₁₀-aryl, where C₃-C₁₀-cycloalkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyloxy or C₆-C₁₀-aryl are optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halo-C₁-C₁₀-alkyl;

C₆-C₁₀-aryl optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₁-C₁₀-haloalkyl, phenoxy, C₁-C₁₀-alkylthio, C₆-C₁₀-aryl, 4- to 10- membered heterocyclic

ring having at least one ring nitrogen, oxygen or sulphur atom, or by NR^bR^c where R^b and R^c are each independently C₁-C₁₀-alkyl optionally substituted by hydroxy, C₁-C₁₀-alkoxy or phenyl or R^b may additionally be hydrogen;

phenoxy optionally substituted by C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or by phenyl optionally substituted by C₁-C₁₀-alkyl or C₁-C₁₀-alkoxy;

a 4- to 10-membered heterocyclic ring having at least one ring nitrogen, oxygen or sulphur atom, said heterocyclic ring being optionally substituted by halo, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, halo-C₁-C₁₀-alkyl, C₆-C₁₀-aryl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyloxy, C₁-C₁₀-alkoxycarbonyl or a 4- to 10-membered heterocyclyl-C₁-C₁₀-alkyl;

-NR^dR^e where R^d is hydrogen or C₁-C₁₀-alkyl and R^e is C₁-C₁₀-alkyl optionally substituted by hydroxy, or R^e is C₆-C₁₀-aryl optionally substituted by halo, or R^e is a 4-to 10-membered heterocyclic ring having at least one ring nitrogen, oxygen or sulphur atom which ring is optionally substituted by phenyl or halo-substituted phenyl or R^e is C₆-C₁₀-arylsulfonyl optionally substituted by C₁-C₁₀-alkylamino or di(C₁-C₁₀-alkyl)amino;

-SRf where Rf is C₆-C₁₀-aryl or C₇-C₁₄-aralkyl optionally substituted by halo, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or C₁-C₁₀-haloalkyl; or

-CONHR^g where R^g is C₁-C₁₀-alkyl, C₃-C₁₀-cycloalkyl or C₆-C₁₀-aryl.

2. A compound according to claim 1, in which

 $X \text{ is } -R^1-Ar-R^2 \text{ or } -R^2-Y;$

Ar denotes a phenylene group optionally substituted by halo, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or by C₁-C₁₀-alkoxy substituted by phenyl;

R1 and R2 are attached to adjacent carbon atoms in Ar, and

either R¹ is C₁-C₁₀-alkylene and R² is hydrogen,

or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6or 7-membered cycloaliphatic ring;

R^a is a bond or C₁-C₁₀-alkylene optionally substituted by hydroxy, C₆-C₁₀-aryl or C₇-C₁₄-aralkyl; and

Y is C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or C₂-C₁₀-alkynyl; C₃-C₁₀-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C₁-C₁₀-alkyl, C₃-C₁₀-cycloalkyl, C₇-C₁₄-

aralkyl, C₇-C₁₄-aralkyloxy optionally substituted by halo, or by C₆-C₁₀-aryl optionally substituted by C₁-C₁₀-alkyl or C₁-C₁₀-alkoxy; C₆-C₁₀-aryl optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, phenoxy, C₁-C₁₀-alkylthio, C₆-C₁₀-aryl, a 4- to 10-membered heterocyclic ring having at least one ring nitrogen atom, or by NR^bR^c where R^b and R^c are each independently C₁-C₁₀-alkyl optionally substituted by hydroxy or phenyl or R^b may additionally be hydrogen; phenoxy optionally substituted by C₁-C₁₀-alkoxy; a 4- to 10-membered heterocyclic ring having at least one ring nitrogen or oxygen atom, said heterocyclic ring being optionally substituted by C₁-C₁₀-alkyl, C₆-C₁₀-aryl, C₇-C₁₄-aralkyl, C₁-C₁₀-alkoxycarbonyl or by a 4- to 10-membered heterocyclyl-C₁-C₁₀-alkyl; -NR^dR^c where R^d is hydrogen or C₁-C₁₀-alkyl and R^c is C₁-C₁₀-alkyl, or R^c is a 4- to 10-membered heterocyclic ring having at least one ring nitrogen or oxygen atom which ring is optionally substituted by halosubstituted phenyl or R^c is C₆-C₁₀-arylsulfonyl optionally substituted by di(C₁-C₁₀-alkyl)amino; -SR^f where R^f is C₆-C₁₀-aryl or C₇-C₁₄-aralkyl optionally substituted by halo or C₁-C₁₀-haloalkyl; or -CONHR^g where R^g is C₃-C₁₀-cycloalkyl or C₆-C₁₀-aryl.

3. A compound according to claim 2, in which

X is $-R^1$ -Ar- R^2 or $-R^2$ -Y;

Ar denotes a phenylene group optionally substituted by halo, C₁-C₄-alkyl, C₁-C₄-alkoxy or by C₁-C₄-alkoxy substituted by phenyl;

R¹ and R² are attached to adjacent carbon atoms in Ar, and either R¹ is C₁-C₄-alkylene and R² is hydrogen,

or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6- or 7-membered cycloaliphatic ring, especially a 5-membered cycloaliphatic ring; R² is a bond or C₁-C₄-alkylene optionally substituted by hydroxy, C₆-C₈-aryl or C₇-C₁₀-aralkyl; and

Y is C1-C4-alkyl, C1-C4-alkoxy or C2-C4-alkynyl; C3-C6-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C1-C6-alkyl, C3-C6-cycloalkyl, C7-C10-aralkyl, C7-C10-aralkyl, C7-C10-aralkyloxy optionally substituted by halo, or by C6-C8-aryl optionally substituted by C1-C4-alkyl or C1-C4-alkoxy; C6-C8-aryl optionally substituted by halo, hydroxy, C1-C4-alkyl, phenoxy, C1-C4-alkylthio, C6-C8-aryl, a 4- to 8-membered heterocyclic ring having at least one ring nitrogen atom, or by NRbRe where Rb and Re are each independently C1-C4-alkyl optionally substituted by hydroxy or phenyl or Rb may additionally be hydrogen; phenoxy optionally substituted by C1-C4-alkoxy; a 4- to 8-membered heterocyclic ring having at least one ring nitrogen or oxygen atom, said heterocyclic ring being optionally substituted by C1-C4-alkyl, C6-C8-aryl, C7-C10-aralkyl, C1-C4-alkoxycarbonyl or by a 4- to 8-membered heterocyclyl-C1-C4-alkyl; -NRdRe where Rd is hydrogen or C1-C4-alkyl and

or 7-membered cycloaliphatic ring;

Re is C₁-C₄-alkyl, or Re is a 4- to 8-membered heterocyclic ring having at least one ring nitrogen or sulphur atom which ring is optionally substituted by halo-substituted phenyl or Re is C₆-C₈-arylsulfonyl optionally substituted by di(C₁-C₄-alkyl)amino; -SRf where Rf is C₆-C₈-aryl or C₇-C₁₀-aralkyl optionally substituted by halo or C₁-C₄-haloalkyl; or -CONHRs where Rg is C₃-C₆-cycloalkyl or C₆-C₈-aryl.

4. A compound according to claim 1 in free or salt or solvate form, wherein X is -R¹-Ar-R² or -R²-Y;

Ar denotes a phenylene group optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₁-C₁₀-alkoxy-C₁-C₁₀-alkyl, phenyl, C₁-C₁₀-alkyl substituted by phenyl, C₁-C₁₀-alkoxy substituted by phenyl, C₁-C₁₀-alkyl-substituted phenyl or by C₁-C₁₀-alkoxy-substituted phenyl; R¹ and R² are attached to adjacent carbon atoms in Ar, and either R¹ is C₁-C₁₀-alkylene and R² is hydrogen, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halogen or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6-

R^a is a bond or C₁-C₁₀-alkylene optionally substituted by hydroxy, C₁-C₁₀-alkoxy, C₆-C₁₀-aryl or C₇-C₁₄-aralkyl; and

Y is C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₂-C₁₀-alkenyl or C₂-C₁₀-alkynyl optionally substituted by halo, cyano, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halo-C₁-C₁₀-alkyl; C₃-C₁₀-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₃-C₁₀-cycloalkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyloxy or C₆-C₁₀-aryl optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or halo-C₁-C₁₀-alkyl;

C₆-C₁₀-aryl optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, C₁-C₁₀-haloalkyl, phenoxy, C₁-C₁₀-alkylthio, C₆-C₁₀-aryl, 4- to 10- membered heterocyclic ring having at least one ring nitrogen, oxygen or sulphur atom, or by NR^bR^c where R^b and R^c are each independently C₁-C₁₀-alkyl optionally substituted by hydroxy, C₁-C₁₀-alkoxy or phenyl or R^b may additionally be hydrogen;

phenoxy optionally substituted by C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or by phenyl optionally substituted by C₁-C₁₀-alkyl or C₁-C₁₀-alkoxy;

- a 4- to 10-membered heterocyclic ring having at least one ring nitrogen, oxygen or sulphur atom, said heterocyclic ring being optionally substituted by halo, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy, halo-C₁-C₁₀-alkyl, C₆-C₁₀-aryl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyloxy, C₁-C₁₀-alkoxycarbonyl or a 4- to 10-membered heterocyclyl-C₁-C₁₀-alkyl;
- -NR^dR^e where R^d is hydrogen or C₁-C₁₀-alkyl and R^e is C₁-C₁₀-alkyl optionally substituted by hydroxy, or R^e is C₆-C₁₀-aryl optionally substituted by halo, or R^e is a 4-

to 10-membered heterocyclic ring having at least one ring nitrogen, oxygen or sulphur atom which ring is optionally substituted by phenyl or halo-substituted phenyl or R^c is C_6 - C_{10} -arylsulfonyl optionally substituted by C_1 - C_{10} -alkylamino or di(C_1 - C_{10} -alkyl)-amino;

-SR^f where R^f is C_6 - C_{10} -aryl or C_7 - C_{14} -aralkyl optionally substituted by halo, C_1 - C_{10} -alkyl, C_1 - C_{10} -alkoxy or C_1 - C_{10} -haloalkyl; or

-CONHR^g where R^g is C₁-C₁₀-alkyl, C₃-C₁₀-cycloalkyl or C₆-C₁₀-aryl.

5. A compound according to claim 4, in which

X is $-R^1$ -Ar- R^2 or $-R^2$ -Y;

Ar denotes a phenylene group optionally substituted by halo, C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or by C₁-C₁₀-alkoxy substituted by phenyl;

 R^1 and R^2 are attached to adjacent carbon atoms in Ar, and either R^1 is C_1 - C_{10} -alkylene and R^2 is hydrogen,

or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6or 7-membered cycloaliphatic ring;

R^a is a bond or C₁-C₁₀-alkylene optionally substituted by hydroxy, C₆-C₁₀-aryl or C₇-C₁₄-aralkyl; and

Y is C₁-C₁₀-alkyl, C₁-C₁₀-alkoxy or C₂-C₁₀-alkynyl; C₃-C₁₀-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C₁-C₁₀-alkyl, C₃-C₁₀-cycloalkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyl, C₇-C₁₄-aralkyl, C₇-C₁₆-aryl; C₆-C₁₀-aryl optionally substituted by halo, hydroxy, C₁-C₁₀-alkyl, phenoxy, C₁-C₁₀-alkylthio, C₆-C₁₀-aryl, a 4- to 10-membered heterocyclic ring having at least one ring nitrogen atom, or by NR^bR^c where R^b and R^c are each independently C₁-C₁₀-alkyl optionally substituted by hydroxy or phenyl or R^b may additionally be hydrogen; phenoxy optionally substituted by C₁-C₁₀-alkoxy; a 4- to 10-membered heterocyclic ring having at least one ring nitrogen or oxygen atom, said heterocyclic ring being optionally substituted by C₁-C₁₀-alkyl, C₆-C₁₀-aryl, C₇-C₁₄-aralkyl, C₁-C₁₀-alkoxycarbonyl or by a 4- to 10-membered heterocyclyl-C₁-C₁₀-alkyl; -NR^dR^c where R^d is hydrogen or C₁-C₁₀-alkyl and R^c is C₁-C₁₀-alkyl, or R^c is a 4- to 10-membered heterocyclic ring having at least one ring nitrogen or oxygen atom which ring is optionally substituted by halo-substituted phenyl or R^c is C₆-C₁₀-arylsulfonyl optionally substituted by halo or C₁-C₁₀-haloalkyl; or -CONHR^g where R^g is C₃-C₁₀-cycloalkyl or C₆-C₁₀-aryl.

A compound according to claim 4, in which X is -R¹-Ar-R² or R²-Y;

Ar denotes a phenylene group optionally substituted by halo, C₁-C₄-alkyl, C₁-C₄-alkoxy or by C₁-C₄-alkoxy substituted by phenyl;

 R^1 and R^2 are attached to adjacent carbon atoms in Ar, and either R^1 is C_1 - C_4 -alkylene and R^2 is hydrogen,

or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6- or 7-membered cycloaliphatic ring, especially a 5-membered cycloaliphatic ring; R² is a bond or C₁-C₄-alkylene optionally substituted by hydroxy, C₆-C₈-aryl or C₇-C₁₀-aralkyl; and

Y is C₁-C₄-alkyl, C₁-C₄-alkoxy or C₂-C₄-alkynyl; C₃-C₆-cycloalkyl optionally fused to one or more benzene rings and optionally substituted by C₁-C₄-alkyl, C₃-C₆-cycloalkyl, C₇-C₁₀-aralkyl, C₇-C₁₀-aralkyloxy or C₆-C₈-aryl; C₆-C₈-aryl optionally substituted by halo, hydroxy, C₁-C₄-alkyl, phenoxy, C₁-C₄-alkylthio, C₆-C₈-aryl, a 4- to 8-membered heterocyclic ring having at least one ring nitrogen atom, or by NR^bR^c where R^b and R^c are each independently C₁-C₄-alkyl optionally substituted by hydroxy or phenyl or R^b may additionally be hydrogen; phenoxy optionally substituted by C₁-C₄-alkoxy; a 4- to 8-membered heterocyclic ring having at least one ring nitrogen or oxygen atom, said heterocyclic ring being optionally substituted by C₁-C₄-alkyl, C₆-C₈-aryl, C₇-C₁₀-aralkyl, C₁-C₄-alkoxycarbonyl or by a 4- to 8-membered heterocyclyl-C₁-C₄-alkyl; -NR^dR^c where R^d is hydrogen or C₁-C₄-alkyl and R^c is C₁-C₄-alkyl, or R^c is a 4- to 8-membered heterocyclic ring having at least one ring nitrogen or sulphur atom which ring is optionally substituted by halo-substituted phenyl or R^c is C₆-C₈-arylsulfonyl optionally substituted by halo or C₁-C₄-alkyl)amino; -SR^f where R^f is C₆-C₈-aryl or C₇-C₁₀-aralkyl optionally substituted by halo or C₁-C₄-haloalkyl; or -CONHR^g where R^g is C₃-C₆-cycloalkyl or C₆-C₈-aryl.

7. A compound according to claim 1 that is also a compound of formula II

in free or salt or solvate form, where

Ar denotes a phenylene group optionally substituted by one or more substituents selected from halogen, C₁-C₈-alkyl, C₁-C₈-alkoxy, C₁-C₈-alkoxy-C₁-C₈-alkyl, or C₁-C₈-alkoxy substituted by phenyl, C₁-C₈-alkyl-substituted phenyl or by C₁-C₈-alkoxy-substituted phenyl,

R¹ and R² are attached to adjacent carbon atoms in Ar, and either R¹ is C₁-C₈-alkylene and R² is hydrogen, C₁-C₈-alkyl, C₁-C₈-alkoxy or halogen or R¹ and R² together with the carbon atoms in Ar to which they are attached denote a 5-, 6- or 7-membered cycloaliphatic ring.

8. A compound according to claim 7 that is also a compound of formula III

in free or salt or solvate form, where R¹ is C₂-C₄-alkylene and R² is hydrogen, or R¹ and R² together with the carbon atoms to which they are attached on the indicated benzene ring denote a 5-membered cycloaliphatic ring, R³ and R⁶ are each hydrogen, R⁴ is hydrogen, C₁-C₄-alkyl, C₁-C₄-alkoxy or C₁-C₄-alkoxy substituted by phenyl and R⁵ is hydrogen or C₁-C₄-alkyl.

- 9. A compound of formula I as defined in claim 1, substantially as described in any one of the foregoing Examples.
- 10. A compound according to any preceding claim for use as a pharmaceutical.
- 11. A pharmaceutical composition comprising as active ingredient a compound according to any one of claims 1 to 9, optionally together with a pharmaceutically acceptable diluent or carrier therefor.
- 12. Use of a compound according to any one of claims 1 to 9 for the manufacture of a medicament for the treatment of a condition which is prevented or alleviated by activation of the β_2 -adrenoreceptor.
- 13. Use of a compound according to any one of claims 1 to 9 for the manufacture of a medicament for the treatment of an obstructive or inflammatory airways disease.

14. A process for the preparation of a compound of formula I as claimed in claim 1 which comprises:

(i) either (A) reacting a compound of formula IV

where X is as defined in Claim 1 and R⁷ denotes a protecting group, to replace R⁷ by hydrogen,

or (B) reacting a compound of formula V

$$R^7$$
—N—X
HO
 S
 O — R^9
 V

where X and R⁷ are as hereinbefore defined and R⁸ and R⁹ each independently denote a protecting group, to convert groups R⁷, R⁸ and R⁹ to hydrogen; and

(ii) recovering the compound of formula I in free or salt or solvate form.